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INCREASES IN CITRUS RED MITE INFESTATIONS AFTER THE APPLICATION OF PARATHION SPRAYS

HERBERT SPENCER AND PAUL A. NORMAN [1]

Parathion has come into extensive use on citrus trees in Florida after four years of experimentation by State (*Thompson et al.*, 1950) and U. S. Department of Agriculture entomologists (*Spencer et al.*, 1952) and after numerous trials by grower associations and grove owners. This insecticide has given excellent control of scale insects,[2] mealybugs,[3] whiteflies,[4] the little fire ant,[5] and certain insects of lesser importance, but has been found to have certain disadvantages in use.

First, parathion is a very poisonous material, and must be handled and applied with great care. Griffiths and associates (1951) have summarized and illustrated the precautions necessary for its safe use.

Secondly, parathion does not give satisfactory control of the citrus rust mite [6] or the citrus red mite (purple mite).[7] The problem of control of the citrus rust mite was easily solved by adding wettable sulfur to the parathion spray, but the problem of combined sprays for the simultaneous control of scales, whiteflies, mealybugs, the rust mite, and the red mite is still partially unsolved.

Spencer and Osburn (1949) reported that in 1947 applications of DDT, tetraethyl pyrophosphate, and parathion not only did not control red mites completely, but also were followed by increases in infestation. Of 300 square inches of leaf and fruit surface examined on trees that had been sprayed on June 17 and October 21 with 1 quart of 20% parathion emulsion concentrate per 100 gallons of water, 7.6% were infested on September 8, as compared with 2.3% on unsprayed trees. On December 19 the infestation ran 11% for those trees sprayed twice with parathion, as against 2.6% for the unsprayed trees. Since these trees were all in the same grove, were in a carefully planned randomized-block design with 10 replications, and received

[1] United States Department of Agriculture, Agricultural Research Administration, Bureau of Entomology and Plant Quarantine.

[2] *Lepidosaphes beckii* (Newm.) and *Chrysomphalus aonidum* (L.).

[3] *Pseudococcus citri* (Risso).

[4] *Dialeurodes citri* (Ashm.) and *D. citrifolii* (Morg.).

[5] *Wasmannia auropunctata* (Roger).

[6] *Phyllocoptruta oleivora* (Ashm.).

[7] *Paratetranychus citri* (McG.).

exactly the same sprays other than the parathion, the conclusion was inescapable that the parathion had brought about this build-up of red mites.

In 1949 a randomized-block experiment was set up in a grove of Temple oranges to study this problem further. There were 10 blocks, or replications, in each of which 2 two-tree groups were randomized. All trees were sprayed in February with zinc sulfate, manganese sulfate, copper sulfate, hydrated lime, and wettable sulfur. The zinc, manganese, and copper can be expected to favor increases in infestations by both scale insects and citrus red mites. On April 12 half the trees were sprayed post-bloom with a mixture of basic copper sulfate, wettable sulfur, and 15% wettable parathion at rates of 3, 5, and 2 pounds, respectively, per 100 gallons. The other half received the same spray with the parathion left out. On May 27 high infestations of the citrus red mite had developed throughout the entire experimental block. Therefore, on May 31 half the trees in each group were sprayed with 1% emulsive oil, and half with 1 pound of 25% wettable parathion plus 6 pounds of wettable sulfur per 100 gallons. The red mite infestations were sampled on June 23. A linen tester lens with 1-inch by 1-inch field was applied to 10 upper leaf surfaces, 10 lower leaf surfaces, and 10 fruits on each tree in search for eggs or crawling stages of red mites. If either or both were present the leaf or fruit was tallied as infested. Percentages of infestation for each treatment are derived from 300 such observations. Data from this sampling showed that the emulsive oil spray had controlled the red mites well, but that the infestation had increased in the trees that had received a second spray of parathion (Table 1).

TABLE 1.—RED MITE INFESTATIONS ON TEMPLE ORANGES AFTER APPLICATION OF PARATHION SPRAYS, 1949.

Sprays (Quantities per 100 Gal.)		Citrus Red Mite Infestations	
April 12*	May 31	May 27	June 23
		Percent	Percent
Parathion (15%) 2 lb.	Parathion (25%) 1 lb., wettable sulfur 6 lb.	76	93
	Emulsive oil 1%	76	5
None	Parathion (25%) 1 lb., wettable sulfur 6 lb.	84	89
	Emulsive oil 1%	84	3

* All trees received basic copper sulfate and wettable sulfur on April 12.

It is clear from Table 1 that parathion in the post-bloom sprays in April did not reduce the red mite infestation materially, since 76% is a high infestation. Statistically, the 76 and the 84% levels did not differ significantly. The emulsive oil spray in May gave excellent control. The trees with heavy infestations in this experiment were cleaned up well early in June with a spray of 1 pound of Neotran [8] per 100 gallons of water.

In 1951 additional information was obtained on build-up of citrus red mites after the application of parathion sprays. A grove of Ruby grapefruit trees was arranged for an experiment, with 10 blocks (or replications), in each of which 6 treatments were applied to randomized single-tree plots. On March 30 all trees in the block were sprayed with 2 pounds of copper oxide plus 5 pounds of wettable sulfur (90%) per 100 gallons. One series of trees received no parathion, four received sprays containing 1 pound of 15% parathion, and one 2 pounds of 15% parathion per 100 gallons.

On May 31, two months after the spraying, citrus red mite infestations were 41.6% on trees that had received no parathion, ranged from 66.3 to 72.6% on the four series of trees that had been sprayed with 1 pound of 15% parathion, and 78% for the trees that had received 2 pounds. The differences between the values for the parathion-sprayed trees and those for the trees that had received no parathion were highly significant. This is another clear-cut case of build-up of citrus red mites after treatment with parathion.

The results of these three experiments show that delayed increases in infestations of citrus red mites may follow the use of parathion in sprays applied in the post-bloom period, in midsummer, or in the fall. Two applications 49 days apart resulted in higher infestations than a single application, and doubling the amount of parathion per 100 gallons in a single spray also increased the infestation. These heavy infestations may require extra oil sprays for control, or the addition of a miticide to the combination spray containing the parathion or to a subsequent wettable sulfur spray.

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[8] A wettable powder containing 40% of bis(*p*-chlorophenoxy) methane.

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HOWARD SAMUEL McCLANAHAN

Howard S. McClanahan, Grove Inspector, State Plant Board of Florida, died on March 4, 1952, at his home in Gainesville, following an illness of several months.

Mr. McClanahan entered the service of the Florida State Plant Board on May 1, 1916, and was assigned to the Citrus Canker Eradication Project with headquarters at Homestead. He resigned in December 1917 to enlist in the Navy, and was mustered out of service late in November, 1918.

In April, 1929, Mr. McClanahan returned to Plant Board work, with assignment to the Mediterranean Fruit Fly Eradication Project. Upon the termination of that project, he was assigned to the Grove Inspection Department, and was in charge of the Citrus Blackfly Eradication Project in Key West from 1934 to 1937. The success of this important project was due in no small measure to Mr. McClanahan's ability to cope with different problems in a manner that inspired respect and confidence on the part of his associates and the public. The next few years were spent in plant quarantine work at Key West, Jacksonville, and Miami. In July, 1940, he was appointed Grove Inspector, with headquarters in Gainesville, the position he held at the time of his death.

With the death of Mr. McClanahan the State Plant Board and the growers of Florida have suffered a great loss because of his great loyalty to his fellow man and his intense interest in the welfare and prosperity of the growers of the State. He was a gentleman in every sense of the word.

Mr. McClanahan was born at Fort Scott, Kansas, May 17, 1891, and came to South Florida in 1912. He attended public schools in Kansas and the Kansas State Agricultural College.

He is survived by his wife, Mabel B. McClanahan, two daughters, Virginia McLane and Mary Faye Schiaffo, and six grandchildren.—W. H. Merrill

THE IMMATURE STAGES OF TWO SPECIES OF FLORIDA SALT MARSH SAND FLIES (Diptera, Heleidae)

WILLIS W. WIRTH [1]

Biting midges, or sand flies, of the genus *Culicoides* Latreille are some of the most troublesome pests of coastal Florida and the southeastern United States. They have been the object of considerable study and effort toward control during the last twenty years, with published reports by Hall (1932); Dove, Hall, and Hull (1932); Hinman (1932); Hull, Dove, and Prince (1934); Hull and Dove (1935); Root and Hoffman (1937); Hull, Dove, and Platts (1939); and Hull, Shields, and Platts (1943).

Recently a renewed attempt has been made at more efficient control, advantage being taken of the new insecticides developed during and after World War II. These efforts have largely been incorporated in the work of the Cooperative Sand Fly Research Unit at Fort Lauderdale, Florida, under the direction of R. L. Goulding, with support from the Department of the Army through the Bureau of Entomology and Plant Quarantine of the U. S. Department of Agriculture, from the Florida State Board of Health, and from the mosquito-abatement districts of Dade, Broward, Palm Beach, and Indian River Counties. It became apparent that before an efficient program of sand fly control could be developed, an intensive biological study of the midges would have to be made. In connection with these biological studies I was invited to spend a few days in August 1951 at the Lantana, Florida, laboratory of the research unit collecting the immature stages of salt-marsh *Culicoides* in order to work out specific characters for their identification. I wish to acknowledge with sincere thanks the valuable assistance and many courtesies received from W. C. McDuffie and J. C. Keller of the Orlando laboratory of the Bureau of Entomology and Plant Quarantine, from R. L. Goulding, W. Byrum and H. Edwards of the Cooperative Sand Fly Research Unit, and from E. L. Seabrook of the Palm Beach County Mosquito District.

The unit's routine sampling procedures, by which soil samples were brought to the laboratory, washed over fine wire screens, and flooded with saturated magnesium sulfate, served very well

[1] Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, United States Department of Agriculture.

for the recovery of larvae and pupae for this study. These insects were then washed in fresh water, killed in hot water, and preserved in 70-80% alcohol. Pupae for rearing were washed in clean water and transferred to individual 13 by 65 mm. shell vials on moist cotton. Mature pupae were also secured in the field by placing a small amount of the top inch of soil in a pan, adding water, stirring thoroughly, and waiting for the pupae to rise to the surface, where they were caught in a pipette and transferred to vials on moist cotton. In this manner the specific identity of the pupae could be accurately determined from reared adults, and the larvae associated with pure rearings of a given species could be reasonably assumed to be related. Since the two important coastal species in lower Florida, *C. melleus* (Coq.) and *C. furens* (Poey), have rather distinct habitat preferences, as determined by emergence traps, it is believed that this assumption is safe. Unfortunately, time and facilities were not available for rearing individual larvae in order to secure positively associated adults. *C. canithorax* Hoffman, the third salt-marsh species of eastern North America, is not common in southern Florida and its immature stages were not studied.

The following descriptions are based on alcoholic specimens which were studied in pure liquified phenol. Specimens so treated are relaxed and cleared, and can be manipulated freely in wet mounts on a depression slide until the aspect desired for description or drawing is obtained. With the use of a thin coverglass and an oil-immersion objective, it is easy to obtain the magnifications up to 950 diameters which are necessary for the examination of the mouth parts and sensory organs on the head capsule of the larva. By clearing with phenol it was found that even the hypopharynx could be examined without dissecting it out of the head, a most difficult procedure. The drawings were made by myself with the aid of a microscope ocular grid or a microprojector.

The excellent and detailed descriptions of the immature stages of various species of *Culicoides* published by Carter, Ingram and Macfie (1920), Painter (1926), Mayer (1937), Tokunaga (1937), Hill (1947) and Williams (1951) have resulted in substantial agreement on the generic characters. Therefore, in this study, emphasis will be placed on characters which a close comparison of these papers indicates will be most fruitful for specific differentiation.

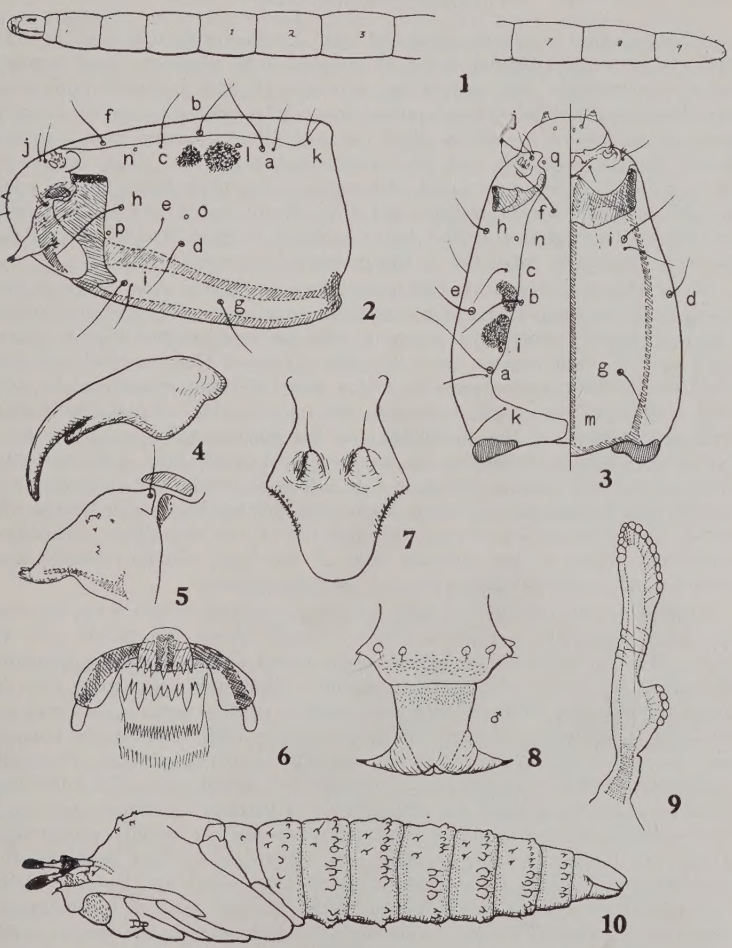

PLATE I. *Culicoides melleus.* Figures 1-6, larva; figures 7-10, pupa. 1, larva, lateral view; 2, head of larva, lateral view, setae and sensilla of head capsule lettered as in text; 3, dorsal view left, and ventral view right, of head; 4, left mandible, ventral view; 5, right maxilla, ventral view; 6, hypopharynx, ventral view; 7, operculum; 8, last segment of male pupa, dorsal view; 9, left respiratory organ, lateral view; 10, lateral view of male pupa.

Culicoides melleus (Coquillett)
(Plate I, Figures 1-10)

MATURE LARVA. Length about 4.8 mm., head capsule 0.22 mm. by 0.13 mm. Body white, without trace of subcutaneous pigment; head capsule creamy, mandibles and supporting sclerites, hypopharynbeal apparatus and three longitudinal ventral sclerotized bands, yellow to amber colored. Body as in Figure 1, with a short cervical sclerite behind head capsule, three thoracic segments and nine abdominal segments. Body segments bare except for five or six pairs of inconspicuous white hairs around each thoracic segment before middle, and four dorsal pairs, two lateral pairs and two ventral pairs of whitish hairs on distal third of last segment. Anal gills not examined; retracted in the preserved material studied.

Head (Figures 2 and 3) with chaetotaxy as figured; two pairs of distinctly separated eye spots. Dorso-median sclerite of head (frontoclypeus) long and narrow, continuous cephalad with the membranous labrum, bearing a pair of small sensory pores dorsally, a pair of blunt, conical, complex sensillae on the anterior margin, and a pair of setae, a pair of sensory pores and a pair of small spines on the ventral side. Antennae located between the bases of the mandibles and the labrum, each consisting of a flat membranous area bearing an anteroventral, ovoid lobe and about five short conical and peglike sensilla. A broad, sclerotized band encircling the ventral and lateral sides of head, with ends arising below and behind antennae and forming the dorsal articulations of the mandibles; this band apparently joined to the anterior ends of the long, slender, median and anterolateral, longitudinal sclerites of the head capsule.

Mandibles (Figure 4) each long and sharp-pointed, with a long, slender, appressed, fingerlike process on inner margin about two-thirds way to apex. Maxillae (Figure 5) membranous, broad at bases, nearly covering the mandibles, each with a long, slender, irregular, supporting sclerite along ventral side, with a hair and several peglike sensilla at base on dorsal side, tapering distad to the apical palpus with an adjacent sensory peg; a number of scattered, minute sensilla on ectal surface. A small, triangular, median, epipharyngeal sclerite on dorsal side of mandibular chamber in region caudad of ventral side of labrum. Labium (mentum) with anterior margin rounded and finely serrate in middle, continuous caudad and lateral with the ventrolateral, sclerotized band of head capsule. Hypopharynx (Figure 6) with dorsolateral arms short and bearing plate-like expansions, without any spines or teeth. Median parts of hypopharynx consisting of four, flattened, posteriorly-fringed plates, the dorsal plate longest and consisting of a very thin, hyaline, fringed veil, the next plate in form of a shorter membrane with denser caudal fringe; the third plate short and yellowish with five short, sharp teeth and six alternating teeth about twice as long, and the anteroventral plate much narrower with seven long posterior teeth.

PUPA. Length about 2.5 mm. Color distinctly brownish, the thickened portions of the respiratory organs and the dorsal tubercles of the cephalothorax almost blackish; abdomen somewhat paler. Cephalothorax with well developed tubercles (Figure 10); four dorsal pairs in mesothroacic region; one below base of each respiratory organ; two pairs on anterior

margin of head region, the inner pair on the operculum considerably ventrad of the pair at the bases of the antennal sheaths. Operculum shaped as in Figure 7, with strong marginal spines just above widest portion at the tubercles, the latter very strong. Respiratory organs (Figure 9) very unusual, each strongly constricted at base, with spiracular openings in two compact groups, about fifteen around rim at apex, and five in a row on the very strongly developed sub-basal hump; in a few specimens there is a single spiracle on a little knob on the dorsal side of the wrinkled and constricted portion in the middle of the organ. Abdominal segments 2-7 each with setigerous tubercles grouped as follows: seven pairs, two anterior and five posterior in dorsal group, three posterior pairs in lateral group and three posterior pairs in ventral group, all the posterior tubercles in line around the segment. Anterior tubercles of dorsal group conical, the posterior tubercles of this group consisting of three submesal pairs of flattened tubercles without setae and two sublateral, contiguous pairs of strong, conical tubercles; tubercles of lateral group strong and flattened with rounded margins; those of ventral group conical and rather strong. First segment with one sublateral pair and eighth segment with posterior row of tubercles only; two sublateral pairs in dorsal group and three pairs in lateral group. Each segment with broad, anterior bands of minute, sharp spinules and posterior band of minute, rounded spinules. Last segment (Figure 8) with apicolateral processes sharp, the blackened thorn-like apices directed laterad, not extending further caudad than middle of segment.

Culicoides furens (Poey)

(Plate II, Figures 11-18)

MATURE LARVA. Length about 4 mm., head capsule 0.17 mm. by 0.12 mm. Body creamy white, neck and thoracic segments with rather uniform, grayish brown, subcutaneous pigment; head capsule yellowish. Thoracic segments each with four pairs of minute hairs, neck and subapical abdominal segments bare; last segment with two dorsal pairs, three lateral pairs, two ventral pairs and a caudal pair of rather long, white hairs. Anal gills long and sharp-pointed, apparently unbranched (Dove, Hall, and Hull, 1932:527, Figure 2, show each gill bifid).

Head (Figures 11 and 12) with chaetotaxy as figured, one pair of reniform eyespots. Antennae (Figure 14, top) each with a broad, low, rounded, anterior lobe and three long and three short, hyaline sensilla in a rounded, membranous area. Labrum bare above, with a pair of lateral groups of three minute conical sensilla just below anterior margin; nearer midline below with a pair of small sensory pores and a pair of sensory pegs. Mandibles (Figure 14, bottom) each with sharp distal tooth and an appressed inner fingerlike process extending three-fourths way to apex. Maxillae (Figure 13) each consisting of a membranous conical lobe bearing a tapered, distal palpus with adjacent hyaline filament of equal length; ectal surface with several scattered, minute sensilla. Labium a median, anteriorly arched plate (mentum) with smooth anterior margin, located between inner side of ventrolateral, sclerotized band of head capsule. Epipharynx a small, tapered, median sclerite with notched distal end,

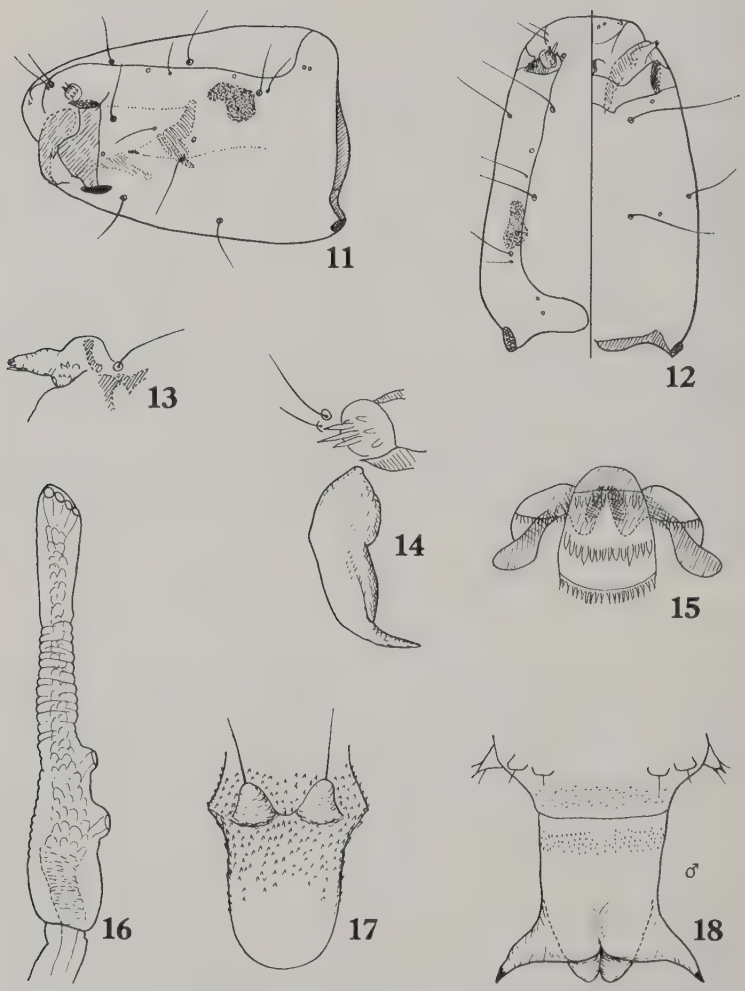

PLATE II. *Culicoides furens.* Figures 11-15, larva; figures 16-18, pupa. 11, lateral view of head; 12, dorsal view left, and ventral view right, of head; 13, right maxilla, ventral view; 14, left antenna above, and mandible below, lateral view; 15, hypopharynx, ventral view; 16, left respiratory organ, lateral view; 17, operculum, and 18, last segment of male pupa, dorsal view.

located on dorsal wall of mandibular cavity just above mentum. Hypopharynx (Figure 15) with dorsolateral arms long and elbowed, each bearing a flattened, plate-like expansion with a transverse comb of very fine spinules across ventral face. Median parts of hypopharynx consisting of three, flattened, posteriorly fringed plates, the dorsal plate longest with fringe of about twenty hyaline teeth, the middle plate strongest with about fourteen strong, nearly equal teeth, and the ventral plate very short with about ten, slender, hyaline teeth.

PUPA. (Compare Fox, 1942, p. 418, figs. 9, 12.) Length about 2.2 mm.; color brown, respiratory organs slightly paler in middle. Cephalothorax with four pairs of small tubercles in mesothoracic region, a strong pair below bases of respiratory organs, a strong pair with long spines between bases of the latter, and a large, spined pair just below on operculum. Respiratory organ (Figure 16) long and nearly straight, very slender on distal half, pale portion on middle third strongly wrinkled transversely, four spiracles in row across apex and two, well separated, dorsal spiracles on pronounced tubercles on basal third; most of tracheal lining coarsely reticulate. Operculum (Figure 17) with strong spines except on rounded dorsal end. Abdominal segments 3-7 each with two pairs of conical anterodorsal tubercles, five pairs of flattened posterodorsal tubercles, one pair of anterolateral tubercles, three pairs of strong, conical, multiple-spinose, posterolateral tubercles, and five pairs of flattened posteroventral tubercles. Each segment with broad, transverse, anterior band of sharp spinules and posterior band of rounded spinules. Last segment (Figure 18) with apicolateral processes sharp, the apices directed slightly caudad.

DISCUSSION

The larvae of *C. melleus* differ remarkably from those of any other known species in the presence of three, longitudinal, sclerotized bars on the ventral side of the head capsule. In all other known species the head capsule, except for the basal articulations of the mouth parts, is more or less uniformly sclerotized. As indicated by Williams (1951:431) the chaetotaxy of the larval head may be of considerable taxonomic importance. Tokunaga (1937:242) apparently is the first to have given definite designations, by letters, to the characteristic setae and sensilla of the head capsule. His observations were based on *circumscriptus* Kieffer and are supported very closely by those of Williams on *tristriatulus* Hoffman and are further confirmed by the two species in the present study. These characters seem to be consistent enough, therefore, to warrant the amplification of Tokunaga's system of letters at this time, by giving a descriptive name to each seta and sensillum, for which I propose the following (see Figures 2 and 3):

a—posteroventral setae
b—posterofrontal setae
c—anterovertical setae
d—ventrolateral setae
e—lateral setae
f—anterofrontal setae
g—posteroventral setae
h—anterolateral setae
i—anteroventral setae
j—antennal setae
k—supra-occipital sensilla
l—postocular sensilla
m—suboccipital sensilla
n—preocular sensilla
o—subocular sensilla
p—postmaxillary sensilla
q—supra-antennal sensilla

The chaetotaxy of the larval head of *furens* is distinctive mainly by the presence of only one pair of anteroventral setae (i) rather than the two pairs of *melleus* and other species. The sensilla of the antennae of *furens* appear to be significantly longer than those of *melleus* and other species; the number present may also be significant but the smaller sensilla are so minute that it is almost impossible to count them correctly. Hill (1947:93) has pointed out differences in the shapes of the mandibles of five British species of *Culicoides*, mainly in the degree of development of the fingerlike process on the inner side. However the mandibular structure of the two Florida species is quite similar, with the long, pointed, distal tooth and well developed inner process usually present in this genus. The hypopharynx offers probably the best larval characters of any structure; in *melleus* there are four posteriorly fringed median plates or lobes, with the most strongly developed plate bearing alternating long and short teeth, while the dorsolateral supporting arms do not bear any spines. In *furens* there are only three median plates on the hypopharynx, the second with nearly equal posterior teeth, and each dorsolateral arm bears a ventral comb of fine spinules.

The pupae of *Culicoides* offer very good specific characters which are much easier to use than those of the larvae. The prothoracic respiratory organs are especially useful, and Fox's (1942) illustrations of those of thirteen American species and Hill's (1947:95) of five British species, should be consulted for comparison. Fox's (1942:423, Fig. 9) drawing of the respiratory organ of *furens* from Puerto Rico differs somewhat from that of the present Florida specimens (Figure 16) in the possession of three, about equidistant, subapical spiracles, rather than two, the extra spiracle occurring just distad of the wrinkled middle portion of the organ. In *melleus* the proximal portion of each respiratory organ is remarkably expanded, forming a striking, dorsal hump bearing a row of five contiguous spiracles not found in any other described species. In a few specimens

there was in addition another dorsal spiracle between the proximal and distal groups; this condition was often found only on one side of the pupa, the other appearing normal. The operculum, which is a median anterodorsal sclerite between the anterior arms of the Y-shaped suture from which the imago escapes, also offers specific characters in the development of the spinose vestiture. In *melleus* the operculum is bare except for narrow rows of spines along the dorsolateral margins, while in *furens* it is densely covered with stout spines except on the dorsal end. In neither species did the shape of the operculum differ between the sexes, as Williams (1951:438) found in *tristriatulus*. The number and development of the setigerous tubercles of the pupal abdomen offer specific characters. The names which were given to these tubercles by Carter, Ingram, and Macfie (1920:223) and Hill (1947:94) are followed here. *C. melleus* lack the anterolateral pair found in *furens* and has three pairs posteroventral tubercles, while *furens* has five pairs. In *melleus* also, the apicolateral processes of the last segment are directed to the side, not at all caudad as is usually the case in this genus.

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NOTES ON THE DISTRIBUTION OF CULICOIDES IN FLORIDA (DIPTERA, CERATOPOGONIDAE)

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This report encompasses a study of species distribution of *Culicoides* in Florida during the period November, 1948, to September, 1950. Specimens were collected principally by light traps in twenty-nine of Florida's sixty-seven counties, ranging from northwest Florida to the Keys area, including inland as well as coastal counties. Infrequent light trap collections from Duval County and a limited number of biting collections from Nassau County are also included.

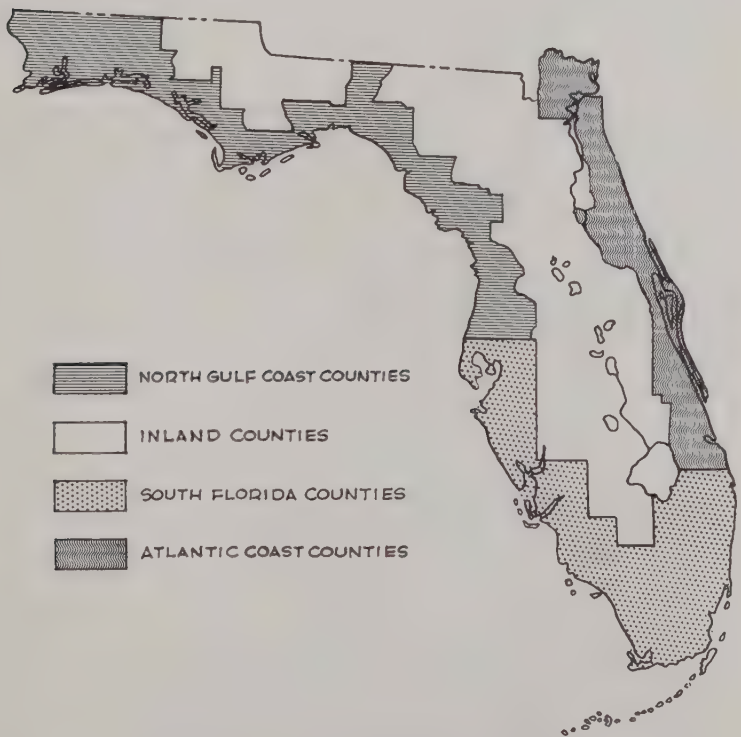

Figure 1. Geographic divisions of Florida to show distribution of *Culicoides*.

A total of over 30,000 specimens has been examined. Twenty species have been identified from the State. In addition, two species not as yet identified are discussed. Twelve species are represented by both males and females, six are based on female specimens alone and two are represented by a single male each. Table 1 shows the distribution by counties of the species collected. For purposes of showing ranges of the species, the State has been divided into four geographical areas (Fig. 1). Inland counties are separated from coastal counties because two species appear to be obligatory salt or brackish water breeders. Six species have thus far been recorded only in west Florida and the north Gulf Coast counties. One species occurs only in extreme south Florida. The Atlantic Coast comprises the fourth area. In this State where there is little variation in elevation and bountiful aquatic breeding areas, there seem to be few known barriers to population spread. The only apparent restricting factor is that certain species seem to require salt or brackish water for breeding.

Culicoides venustus Hoffman: This species has been found in four counties, all on the northwestern Gulf Coast. It was taken infrequently and usually only one or two specimens at a time. It resembles *C. guttatus* rather closely. The terminalia of *venustus* differ from *guttatus* by having the parameres entirely separate in *venustus* while they are connected by a narrow strip at the base in *guttatus;* the apicolateral processes of the ninth tergite are slightly longer in *guttatus.* The only two males of *venustus* were taken from Pasco County and are distinctly that species, showing no characteristics suggesting intergradation.

Culicoides guttatus (Coquillett).[1] *C. guttatus* is one of the most widespread *Culicoides* in Florida. It has been taken in twenty-two counties, inland and coastal. This form was described by Fox and Hoffman (1944) from Puerto Rico as *C. inamollae.* Twelve male terminalia from six Florida counties were compared with males taken at Carolina, Puerto Rico, the type locality for *inamollae,* and appeared to be the same. Lane (1949) synonymized *inamollae* with *guttatus.* It has been found that the size of Florida specimens varies and many specimens have a fairly distinct mesonotal pattern not unlike that of *C. venustus.* In Root and Hoffman's key (1937) this species keys out to the couplet containing *C. luteovenus* and *C. venustus.*

[1] Syn. *C. inamollae* Fox and Hoffman, 1944.

Culicoides obsoletus (Meigen): A single female of this species was taken in Marion County in June, 1950.

Culicoides arboricola Root and Hoffman: This species was taken from seventeen counties, coastal and inland, extending from west Florida to the Keys. In Root and Hoffman's key this species is separated from *guttipennis* in part on the basis of its smaller size, though the text states that specimens from Georgia run larger than the type material. Florida specimens are also larger, frequently as large as the reported size of *guttipennis*. Some male terminalia show slight differences from the drawing given by the original authors, but these do not appear to be of specific importance.

Culicoides villosipennis Root and Hoffman: Light traps in eight counties yielded this species. It ranges along the Gulf Coast from extreme northwest Florida to the Keys. It was also found in one inland county. *C. villosipennis* was usually rare, with only one specimen to a collection; however, a single collection from Taylor County in July, 1949, yielded seven specimens. No males of the species were collected.

Culicoides canithorax Hoffman: This species is known to occur in twenty-one counties, both on the coast and inland. Some specimens are larger and have more distinct wing markings than others. Hoffman (1926) described these as *mississippiensis* but later expressed some doubt of the validity of this species. Wing markings varied greatly in this species, ranging from clearly marked to some in which the light spots are so indistinct as to appear to be entirely lacking. A total of twenty-five male terminalia examined from six counties appeared to exhibit very little variation; furthermore the distinctness of the wing pattern was not constant even in one geographical area. For these reasons they are all considered to be *canithorax*. This species is taken in very large numbers in the spring months, vying with *furens* and *guttatus* as the species most widely distributed and most abundant. A single collection from Walton County in March, 1950, yielded over 2700 *canithorax*.

Culicoides crepuscularis Malloch: *C. crepuscularis* has been recorded from seventeen counties; these counties include inland and coastal areas, ranging from northwest Florida to the Keys.

Culicoides biguttatus (Coquillett): This species has been recorded from five Gulf Coast counties; it was taken only occasionally and there were never more than a few specimens per collection.

Culicoides travisi Vargas (1949):[2] *C. travisi* has been taken in only three counties. No males of either this species or *biguttatus* have been collected.

Culicoides nanus Root and Hoffman: This species is represented by only two or three female specimens taken from a trap at Innerarity Point in Escambia County during the summer of 1950.

Culicoides niger Root and Hoffman: Light traps in two counties, Citrus and Walton, have yielded this species. It is apparently seasonal, occurring in great numbers for a short period in spring; from then on it is rarely found. A single male was taken from Walton County and one from Citrus County.

Culicoides melleus (Coquillett): This species was described from Florida specimens. It occurs in thirteen counties, all coastal, both on the Atlantic and Gulf Coasts. It was especially abundant in Escambia, Walton, and Dade Counties. It is a particularly annoying species at the beaches. The male is being described elsewhere by Pratt and Foote.

Culicoides furens (Poey): *C. furens* is the most widely distributed species in Florida and probably the most abundant. It occurs by the thousands in light trap collections from the Florida Keys and from Lee County. It was collected from twenty-one counties, all coastal. A single doubtful record occurred in Alachua County in north central Florida.

Culicoides stellifer (Coquillett): Records show that this species was found in twelve counties, inland and coastal. It has not been recorded from extreme south Florida.

Culicoides baueri Hoffman: This species has been taken in only two counties, Duval and Marion. Both males and females were collected.

Culicoides piliferus Root and Hoffman and *Culicoides spinosus* Root and Hoffman: Both these species are thus far represented by single males taken from Escambia light trap collections.

Culicoides loughnani Edwards: This species was described from Jamaica, and to date has not been reported from any other area. The occurrence of this species in Florida represents the first record in continental North America. For this reason, it seems desirable to list the locality data on the specimens which have been taken. It occurred in six counties, all on the southwestern coast. Specimens are from:

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[2] Syn. *C. simulans* Root and Hoffman, 1937.

Pinellas Co., Weedon Island Bridge near St. Petersburg
Manatee Co., Longboat Key
Lee Co., Punta Rassa, Captiva, and four traps on Sanibel Island
Sarasota Co., Englewood
Collier Co., Marco
Monroe Co., Islamorada and Marathon.

On May 16, 1950, twenty-two specimens were captured in a light trap on Sanibel Island. In all about eighty-five females and three males have been taken; most of these were trapped from April through August.

The following descriptive notes are offered on the Florida material:

FEMALE.—This is a large species, about two mm. in length and heavy bodied. Head black. Last five segments of antennal flagellum slightly longer than the first eight. Palpi with second segment less than half as long as the third; third much swollen with a small deep pit; last two segments short and subequal.

Mesonotum black with short fine light hairs. Mesonotal pattern distinct, consisting of two narrow light stripes extending from the sensory pits back to encircle the prescutellar spots. Two light circular areas lie on each side laterad to the stripes. Legs light yellowish, knees black with white bands above and below, tarsi lighter.

Wing with macrotrichia dense over most of the wing, wing background grey, but light areas are large and confluent giving the wing a very light appearance. Two conspicuous dark spots, one over second radial cell and one about halfway between second radial cell and tip of the wing in cell R5.

Abdomen light yellowish brown. Spermathecae two, cylindrical and about two and one-half times as long as wide. Rudimentary spermatheca and ring present. In Root and Hoffman's key this species keys out to the couplet containing *C. crepuscularis* and *C. copiosus*.

The male is being described elsewhere by Pratt and Foote.

Culicoides floridensis Beck (1951): This species, closely resembling *C. melleus*, was first discovered during the course of this study. There are no new distribution records to date.

During this investigation, two species were found which do not seem to fit any of the above discussed species. Species "A" is similar to *canithorax*, except the spermatheca is much larger, the wings narrower and completely lack spots; the wing is gray with a slightly darker area over the second radial cell. Single specimens were collected from Escambia County and Sarasota County. Species "B" is very nearly identical to *crepuscularis* except that the spermatheca is much elongated, being at least five times as long as wide. This species occurs in eight counties

TABLE 1

DISTRIBUTION OF CULICOIDES IN FLORIDA 1948-1950

	North Gulf Coast								South Florida										Atlantic Coast					Inland Counties				
	Escambia	Walton	Bay	Franklin	Taylor	Citrus	Hernando	Pasco	Pinellas	Hillsborough	Manatee	Sarasota	Charlotte	Lee	Collier	Dade	Monroe	Broward	Palm Beach	St. Lucie	Brevard	St. Johns	Duval	Nassau	Alachua	Marion	Sumter	Lake	Polk
C. venustus	*	*			*			*											*	*					*	*			*
C. guttatus		*	*			*	*	*	*	*	*	*	*	*	*										*		*	*	*
C. obsoletus																													
C. arboricola	*	*			*	*	*	*	*	*	*	*	*	*	*						*					*			
C. villosipennis	*	*			*	*								*	*														
C. canithorax	*	*	*		*	*	*	*	*	*	*	*	*	*	*														
C. crepuscularis	*	*	*		*	*	*	*	*	*	*	*	*	*	*														
C. biguttatus	*	*			*																								
C. travisi	*	*			*																								
C. nanus	*																												
C. niger						*																							
C. melleus	*	*	*			*	*		*	*	*	*	*	*	*	*	*	*											
C. haematopotus	*	*							*	*	*	*	*	*	*	*	*		*	*									
C. furens	*	*	*	*			*	*																					
C. stellifer	*	*	*																										
C. baueri																													
C. piliferus	*																												
C. spinosus	*																												
C. loughnani									*																				
C. floridensis																													
Species "A"	*																			*									
Species "B"					*																*						*		*

in which *crepuscularis* occurs, and in one from which that species has not been recorded. Further work will have to be done on both these forms before their status can be ascertained with certainty.

SUMMARY

1) This study is based on an examination of over 30,000 specimens of *Culicoides* identified from twenty-nine Florida counties.

2) Twenty species of *Culicoides* are identified from the State; two species of undetermined status are discussed.

3) Three species, *C. piliferus*, *C. spinosus*, and *C. nanus*, are recorded only from Innerarity Point in Escambia County.

4) Florida records and additional description are given for *C. loughnani*, a species not previously recorded from continental North America.

The author wishes to acknowledge the aid of Dr. W. W. Wirth of the U. S. National Museum, and Mr. R. H. Foote of the U. S. Public Health Service, during this study.

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CELITHEMIS BERTHA WILLIAMSON IN FLORIDA WITH A DESCRIPTION OF A NEW SUBSPECIES (ODONATA)

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Department of Biology, University of Florida

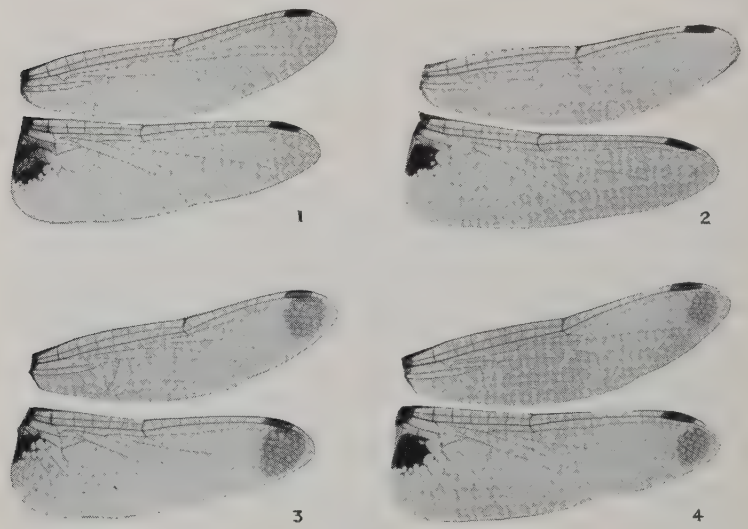
While Mr. Richard P. Trogdon, an instructor of Biology at Jacksonville Junior College, Jacksonville, Florida, was collecting Odonata in northwest Florida in June, 1950, he saw a wary dragonfly which he was unable to identify. After much effort he succeeded in capturing the insect and brought it to me some time later in Gainesville. I immediately expressed the desire to examine more, and on a return trip in September Mr. Trogdon was able to catch eight males. He did not find a female. A still later trip, July 21, 1951, yielded six males.

In general body form and coloration the specimens were like *Celithemis bertha* Williamson, but each had large apical spots in the wings which were not present in any specimen of *bertha* we had collected from central Florida. It was thought to represent a new species and a description was prepared. The manuscript, accompanied by a paratype, was submitted to several other odonatologists and they agreed that it was apparently a new species. When the specimen was seen by Mrs. Leonora K. Gloyd, it brought back memories of specimens of *bertha* that had been taken by members of the Williamson-Ditzler expedition in northwest Florida during August and September of 1932. She requested that Miss Ada L. Olsen send me all specimens of *bertha* from the Williamson collection which were taken on that trip. They were soon received, and of the seventy-eight specimens labeled *bertha* from Mystic Lake in Liberty County and from Madison County, there were several similar to the one I was describing as new. Others showed only the slightest trace of spots, some in only one pair of wings. This was interesting since I had suggested the possible existence of such intermediates in the original manuscript. Here was an apparent case of interbreeding of the two species at certain lakes, and their distinctness as different species faded away.

Further study showed that of many specimens we had from Lake Placid in Highlands County north to Gold Head Branch State Park in Clay County, separated by a distance of about 160 miles in a straight line, not one showed any indication of apical spots in the wings. The specimens taken and seen by Mr. Trogdon in Bay County all had large spots. Thus it appears

that the ranges of the spotted and unspotted forms overlap in the area around Tallahassee where the Williamson-Ditzler expedition collected.

The matter was laid aside until I read the recent paper by E. M. Walker in which he describes three subspecies of *Sympetrum occidentale* which apparently differ only in wing markings and do show in some cases intermediates. The publication of Dr. Walker's paper encouraged me to continue the study of the similar problem in *Celithemis*. Though subspecies have been little recognized in the Order Odonata, this appears to be a clear case of two forms with separate ranges which meet in the region around Tallahassee. Such intermediates as found would be expected from the subspecies concept. Further study of the genetics involved is needed, as well as more data on the exact distribution of the two forms.



Wing photgraphs. All figures of males.

Fig. 1. *Celithemis bertha bertha*, Lake Placid, Florida, J. G. Needham.

Fig. 2. Intermediate between *Celithemis bertha bertha* and *Celithemis bertha leonora*, Leon County, Florida, June 6, 1951, W. H. Cross.

Fig. 3. *Celithemis bertha leonora*, Bay County, Florida, September 8, 1950, R. P. Trogdon.

Fig. 4. *Celithemis bertha leonora*, Bay County, Florida, June 7, 1950, R. P. Trogdon.

Celithemis bertha Williamson

This species was described in 1922 by E. B. Williamson from a series of 68 males and 8 females collected in Florida, all from Enterprise, with the exception of two males and two females from Gotha. The holotype and allotype, taken at Enterprise, are in the Williamson collection. There was no mention made of any indication of a spot near the apex of the wings, nor did such a spot show on any of the three photographs. Two photographs show a considerable variation in the basal wing spots. One of them shows some color at the base of the front wing and a large spot in the hind wing. The other shows no color in the front wing base and only a small spot in the hind wing. For the characterization of this species we refer the reader to Mr. Williamson's paper. That characterization will now have to be expanded to cover the specimens of both subspecies to be described herein, one of them having the apical spots in all wings.

Celithemis bertha Williamson **bertha** subsp. n.

The color pattern of the body in this subspecies is essentially like that of the following and one description will do for both. There is no indication of a dark spot in the apex of any wing. The original types of the species *bertha* are here considered as the types of this subspecies, and all specimens of the type series belong here also. In addition, I have examined a number of other specimens. The following abbreviations for collectors are used in the distribution records: EBW—E. B. Williamson, EMD—E. M. Davis, MJW—M. J. Westfall, Jr.

MATERIAL STUDIED: *Clay Co.*—Pebble Lake, Gold Head Branch State Park: 2♂♂, MJW, 5♂♂, R. P. Trogdon, 8/12/50; 5♂♂, R. P. Trogdon, 8/5/51. Keystone Heights: Reared ♂, ♀, MJW, 5/14/50. *Highlands Co.*—Lake Placid: Large series collected by J. G. Needham; 1♂, 2♀♀, MJW, 4/19/52. *Leon Co.*—East end of Lake Hall: ♂, W. H. Cross, 6/6/51. Lake Bradford: ♂, W. H. Cross, 6/21/51. *Liberty Co.*—Mystic Lake: 60♂♂, 2♀♀, EBW et. al., 8/20 - 21/32. *Madison Co.*—Pond near Greenville: 3♂♂, EBW et al., 9/2/32. Logan Lake: ♂, EBW, et. al., 9/3/32. Lake San Paylor: 2♂♂, EBW et. al., 9/5/32. *Orange Co.*—Maitland: ♂, W. Atlee, 5/12/35. Orlando: 2♂♂, EMD, 4/17/35. Windermere: 2♂♂, Frank Holland, 7/23/39; ♀, EMD, 5/3/41. Winter Park: ♂, ♀, MJW, 9/5/41; ♂, J. A. Fluno, 7/31/35; 3♂♂, J. A. Fluno 6/22/35; ♂, EMD, 10/27/35; ♂, EMD, 4/24/35; reared 6♂♂, 8♀♀, MJW, 4/11 - 22/41. *Seminole Co.*—♂, ♀, EMD, 4/13/36.

The specimens from Liberty and Madison Counties are in the Williamson collection at Ann Arbor, Michigan. Those

from Highlands County taken by me are in my collection; those taken by Dr. Needham are in the collections of Cornell University and the Academy of Natural Sciences at Philadelphia. The male from Lake Bradford, Leon County, is in the collection of Mr. Cross. All others are in my collection.

Celithemis bertha leonora subsp. n.[1]

MALE.—Face, frontal vesicle and occiput cherry red in life. Area surrounding ocelli black. Distal edge of labrum and median longitudinal band on labium, black. Occiput clothed behind with long light hair. Back of head black except for small yellow spot next to the compound eye.

Prothorax almost entirely black. Ground color of synthorax is orange to reddish brown with metallic blackish markings. A mid-dorsal stripe widens downward to the collar. The humeral suture bears a dark stripe, constricted in its middle portion, which is broadly continuous around the lower side of the mesepimeron with a stripe on the obsolete first lateral suture. This stripe widens suddenly at the metathoracic spiracle to form a quadrangular black area which is separated from the expanded upper end of the humeral stripe by a distance equal to the greatest width of the stripe above the spiracle. The second lateral suture is overspread by a dark stripe that runs posteriorly along the crest above and is joined by a hair streak to the first lateral stripe below. As in *bertha bertha* the pale area of the mesepimeron, the pale area above on the metepisternum, and the pale area below on the metepisternum are all joined above.

Legs black, lighter near bases. Inferior surfaces of front femora light tan at base.

Wings with costa and all main veins near base in both wings red. Other veins black. All wings with apical brown spots which, however, do not reach the apical margin in any of the specimens seen. The most extensive spot in the front wing reaches from the stigma to one row of cells beyond Rs but not quite to the wing margin. It extends from the base of the stigma outward in the wing for approximately 4 mm. The maximum spot in hind wing is just slightly more extensive. The size of the spots is variable but in all specimens of this subspecies, a spot can clearly be seen near the apex of each wing. The size of the basal spot in the hind wing is also variable, the one with the largest spot having the brown continuous from the base to A_1 or slightly beyond, also with an isolated small spot at lower inner angle of triangle. The base is yellow-tinged between Sc and R, and to a lesser extent between C and Sc, to the first antenodal crossvein at most, with only a little color around the second antenodal between Sc and R. The median space is largely hyaline and the cubital space tinged with yellow to first cubito-anal crossvein. Figure 3 shows about the minimum coloration of the basal area. The front wings without a basal spot in all specimens observed.

Abdomen black and bright red in all the type series. There are no tenerals at hand but as in the subspecies *bertha*, younger specimens would

[1] I am following an early precedent of naming the species in this genus for women and name this subspecies in honor of Mrs. Leonora K. Gloyd whose fine reputation as an odonatologist needs no elaboration.

no doubt have the pale areas yellow. Segments 1 and 2 broadly red on sides, with only a dorsal band and lower corners of the tergites black; 3 with an apical dorsal spot and an apical lateral spot each side black, remainder red; 4 red above the lateral carinae except for a triangular spot of black each side at apex of segment, with apex of the triangle directed anteriorly and reaching about half the length of the segment. Median transverse carinae of segments 2-4 also dark. Segments 5-7 black, with mid-dorsal red spots which are more or less spear-shaped and almost full-length, with points directed to rearward; 8-10 entirely black. Superior appendages yellowish-brown with base and extreme tips black; or in older specimens almost entirely black. Inferior appendages black.

Total length 31 - 32.5 mm.; abdomen 20 - 21; hind wing 24-25.

FEMALE.—Like the male except in minor details. Face is yellowish in mature specimens instead of cherry red, while the synthorax is yellowish-brown instead of orange to reddish-brown. Middorsal dark stripe is wider than in male, sharply constricted in the upper fourth. Dark markings of the sides of thorax are slightly more extensive and more contrasty in female.

Wings with base of costa yellow, as well as veins in the basal colored area. Main veins basally light brown, shading to black apically. Largest spot in front wing from stigma to Rs but stopping about two cells short of the apical wing margin. Hind wing with cubital space yellowish to first cubito-anal crossvein. In one specimen brown extending along the anal vein to first cubito-anal, but only two or three basal cells filled with brown. In second specimen brown does not completely fill a single cell in one wing; borders only of two or three cells darkened. Apical spots all large in the three females, as large or larger than in the male shown in figure 4.

Abdomen not so red as in the male. Appendages brown to black.

Total length 27-28 mm.; abdomen 17-18; hind wing 23-24.

HOLOTYPE ♂ AND ALLOTYPE ♀: *Liberty Co.*—Mystic Lake: EBW et. al., 8/20/32; in the Williamson collection, Museum of Zoology, Ann Arbor, Michigan.

PARATYPES (32 ♂♂, 2♀♀): *Bay Co.*—Sunnyside Beach: 8♂♂, 9/8 - 11/50, 1♂, 6/7/50, 6♂♂, 7/21/51, R. P. Trogdon. *Leon Co.*—Lake Bradford; 1♀, W. H. Cross, 6/21/51. *Liberty Co.*—Mystic Lake: 13♂♂, 1♀, EBW et. al., 9/20 - 21/32. *Madison Co.*—Logan Lake: 2♂♂, EBW et. al., 10/3, 7/32. Pond near Greenville: 2♂♂, EBW et. al., 10/2/32. All of the specimens except those from Bay and Leon Counties are in the Williamson collection. One of the Bay County specimens is in the Cornell collection, another in the collection of the Academy of Natural Sciences at Philadelphia, another in the collection of Mrs. Leonora K. Gloyd, and the others are in my collection at the present time. The ♀ from Leon County is in the collection of Mr. Cross.

In all of the Bay County specimens the basal brown spot extending from the wing margin to vein A (spot *a* of Williamson) is not bounded on the outer side by yellow, nor is there any indication of Williamson's spot *c*. In the Tallahassee area where both subspecies occurred in the same lakes, this was true of

most specimens of *leonora*, but a few showed a "washing out" of the brown basal spot on the outer side to give an appearance of a yellow edging. In *bertha* from the southern part of the state there seems always to be an edging of yellow around the basal brown spot, and most often (though not always) there is a well-defined dark spot *c* beyond the yellow edging as shown in our figure 1. No spot *c* was apparent in any with or without the apical wing spots taken in the Tallahassee area.

Two males from Leon County are unique. Both have the basal spot *a* very large, yet there is no yellow edging, nor is there a spot *c*. One shows a prolongation of spot *a* to the inner side of the triangle, giving a resemblance of a spot *b* of Williamson. One of the two has a faint indication of an apical spot in each wing and has been listed as intermediate between *bertha* and *leonora*. A pair of its wings is shown in figure 2. The other specimen has no indication of apical spots, and has been listed with *bertha*.

The variation in size of the basal spot seems to occur at both ends of the known geographical range. One specimen from Bay County, the one shown in figure 4, has much larger basal spot *a* than the others. This was the one collected in June; those taken in September show much smaller spots. At first it was thought this might be correlated with season, but this theory seemed to break down under the evidence. Williamson's specimens from Enterprise exhibited such variation in size of the basal spot, and were collected on the same date.

The genitalia of the two subspecies are very similar. The various species of *Celithemis* are hardly distinguishable by differences in genitalia, and in this respect the subspecies of *Sympetrum occidentale*, as described by Walker, are almost identical with each other.

A comparison of venational characters of *bertha* and *leonora* has been made, using the same characters employed by Williamson in his 1922 paper. Five specimens (ten pairs of wings) of *leonora* from Bay County were used. The same number was used for *bertha* from Enterprise in Williamson's tabulation. The results show the two subspecies to be identical in most respects. Where there is an apparent difference, the tabulations are compared below. The figures under the subspecific names in the tabulation are percentages.

It was noted that Williamson (1922, p. 12) listed only one of the ten front wings of *bertha* with Rs and Rspl separated by

2 rows of cells for 1 cell's length. Several specimens of *leonora* showed double cells, so an examination was made of 16 wings of *leonora* and 38 wings of *bertha*. In *leonora* 12.5% had no double cells between Rs and Rspl in front wing, 25% had one double, 56.25% had 2 double and 6.25% had 3 double. In *bertha* 81.58% had no double cells, 13.16% had 1 double and 5.26% had 2 double. Likewise, only four of the 16 *hind wings* of *leonora* lacked at least one double cell between Rs and Rspl.

CHARACTERS		*bertha*	*leonora*
Antenodals, front wing	7	50	60
	8	50	30
	9		10
Antenodals, hind wing	4		10
	5	100	90
Postnodals, front wing	5		20
	6	100	50
	7		30
Postnodals, hind wing	6	10	60
	7	60	40
	8	30	
Triangle front wing, followed by:			
3 cells, then 2 for 1 - 3 rows, then 3		80	100*
3 cells, then 3		20	

* One wing has the first row of 4 cells; another has 3 cells followed by 2 for 6 rows, then 3.

Following Mrs. Gloyd's suggestion, a comparison was made of certain wing measurements in the two subspecies. The Bay County specimens were compared with central Florida ones. In *leonora* the greatest width of the hind wing is equal to or slightly greater than the distance in the front wing from nodus to proximal end of pterostigma; in a long series of *bertha* the greatest width of the hind wing is slightly less than the distance in front wing from nodus to pterostigma.

Of the specimens studied, three males were recognized as intermediate between the subspecies *bertha* and *leonora*. Two were from the Williamson collection. One of these was from Lake Mystic, August 20, 1932 and the other from Logan Lake, September 3, 1932. In the first there is only a very faint indication of spots in the front wings, small ones in the hind wings. In the second, there are only small spots in the hind wings, none in the front. The third specimen from Leon County, June 6, 1951, collected by W. H. Cross and illustrated in figure 2, shows

in all wings such minute spots, hardly visible, that it is also considered an intermediate.

Because of the apical wing spots, *b. leonora* will key out in Williamson's 1922 key along with *eponina, elisa, monomelaena,* and *fasciata* in the first rubric, rather than with *b. bertha.* The subspecies *leonora,* as shown, also shows a tendency to have double cells between Rs and Rspl as in the *eponina* group.

C. bertha, as far as known, has been collected only in Florida from March 31 to December 3. The subspecies *bertha* seems to be from the peninsula, and intergrades with *leonora* in the Tallahassee region. It is thought that *leonora* may occur westward into Alabama and northward into Georgia. Wherever we have taken *bertha* it has been around sand-bottomed lakes, such as Lake Mystic in Liberty County. Pebble Lake at Gold Head Branch State Park is one of the smallest at which we have collected it. In Bay County, Mr. Trogdon took *leonora* at a small lake or pond about 100 yards from the post office at Sunnyside Beach. In size, the body of water is about 100 yards wide and 250 yards long, with an additional area of cattails at one end extending another 100 yards. It is a fresh water pond normally, but very close to the Gulf, and during storms of hurricane force, salt water invades it through the culvert by means of which its waters drain out into the Gulf. Additional specimens not collected were seen by Mr. Trogdon at other similar ponds along the road for several miles. These dragonflies perch on the outermost weed in the lake and are often difficult to capture from the shore.

I wish to express my gratitutde to Mrs. Leonora K. Gloyd for her helpful suggestions and to Dr. J. Speed Rogers and Miss Ada Olsen of the Museum of Zoology, University of Michigan, for the loan of specimens. I wish also to thank Dr. C. Francis Byers, Dr. James G. Needham, and Dr. Philip P. Calvert for examining paratypes and making suggestions with regard to the manuscript. Special thanks are due to Mr. Trogdon for bringing this problem to my attention and for turning over his specimens to me for study.

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FOOD PLANTS AND NEW RECORDS FOR SOME HEMIPTERA IN FLORIDA

ROLAND F. HUSSEY
Lakeland, Florida

Theognis gonagra (Fabr.).—This large coreid was plentiful during the winter of 1949-50 on some Brazilian pepper trees (*Schinus terebinthefolia*, fam. *Anacardiaceae*) bordering my yard in Lakeland, where specimens were taken from November until March. Some were seen on the foliage, but most of them were on the bright red berry clusters, with sometimes four or five individuals on a single cluster. In Brazil this species is known as a pest on Cucurbitaceae, and Goncalves (O Campo, 8:52, 1937) has reported it as found on one occasion sucking the juice from oranges, but I did not observe any specimens on the foliage or the fruit of the orange trees standing within a few yards of the *Schinus*. This bug has not reappeared here since the spring of 1950. During that same winter the common *Theognis phyllopus* (Linn.) was also seen occasionally on these trees, but the *Schinus* is not one of its preferred plants.

Chelinidea vittigera aequoris McAtee.—This cactus coreid has not been reported previously from Florida. I have looked for it without success on the prickly pears that grow sparingly in the oak scrub south of Lakeland. I have, however, one specimen of the color form *artuatra* McAtee which I found dead on my driveway on June 17, 1949. There are two specimens in the Museum of Zoology of the University of Michigan that were collected at Rock Bluff in Liberty County in March, 1929, and one from Alachua County taken in April, 1923.

Oncopeltus fasciatus (Dallas).—The common milkweed bug of the northern states is most often found in Florida on the cleander. It is seldom numerous; most oleander plants are without these bugs, and only rarely are more than two or three adults found on a single bush. I have taken adults and nymphs of all stages on oleander at Lakeland during the early days of May; and the University of Michigan Museum has specimens labelled as taken on the same host plant at Gainesville.

Kleidocerys championi (Distant).—This small lygaeid, described from Guatemala, was first reported from Florida in 1926 by Blatchley, who found it abundantly on roadside vegetation at Dunedin. I first encountered it in numbers on November 10,

1950, when I took adults and nymphs on goatweed (*Scoparia dulcis*, fam. *Scrophulariaceae*) growing in a vacant lot in Lakeland. This plant, introduced from Mexico, has escaped from cultivation and now grows wild in this area. It is of interest to note that both this species and *Theognis gonagra* are essentially neotropical in their distribution and that they occur in this region on plants introduced from neotropical areas.

Perigenes similis Barber.—This lygaeid was described from Brownsville, Texas, and has been recorded as far north as Missouri, but has not been reported heretofore from Florida. It is the only member of the genus that I have found at Lakeland, and probably the specimens from Dunedin that Blatchley reported as *P. constrictus* (Say) should be placed here. It is frequently seen at lights in summer. The University of Michigan Museum has a series of *P. similis* collected by Dr. Hubbell at Valdosta, Georgia, on June 9, 1936. Mr. Barber has kindly verified my identification of this species.

Pycnoderes angustatus Reuter.—This mirid, described from Jamaica, is a new addition to the hemipterous fauna of the United States. I took several specimens on April 19, 1949, from tangled vines in a wet woodland beside the Peace River about one mile north of Bartow, Florida. I am indebted to Dr. J. C. M. Carvalho for the identification of these specimens.

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